INDIANA UNIVERSITY
TRANSPORTATION RESEARCH CENTER
School of Public and Environmental Affairs
222West Second Street
Bloomington, Indiana 47403-1501
(812) 855-3908 Fax: (812) 855-3537

REMOTE AIR BAG DEPLOYMENT REPORT

CASE NUMBER - IN99-036
LOCATION - Wisconsin
VEHICLE - 1998 BUICK CENTURY CUSTOM
CRASH DATE - June 1998

Submitted:

August 20, 1999

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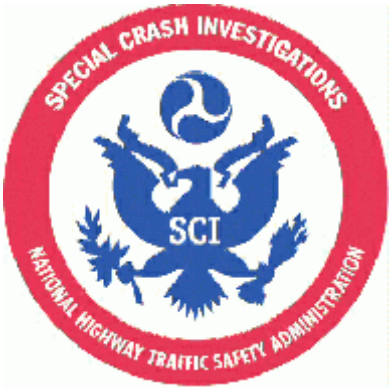
June 4, 2001



Contract Number: DTNH22-94-D-17058

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The crash investigation process is an inexact science which requires that physical evidence such as skid marks, vehicular damage measurements, and occupant contact points be coupled with the investigator's expert knowledge and experience of vehicle dynamics and occupant kinematics in order to determine the pre-crash, crash, and post-crash movements of involved vehicles and occupants.

Because each crash is a unique sequence of events, generalized conclusions cannot be made concerning the crashworthiness performance of the involved vehicle(s) or their safety systems.

Technical Report Documentation Page

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15. *Supplementary Notes*

Remote air bag deployment report involving a 1998 Buick Century Custom, with manual safety belts and dual front redesigned air bags, a 1994 Pontiac Grand Am SE, a 1988 Chevrolet K2500 pickup truck, and a 1983 Buick LeSabre Limited.

16. *Abstract*

This report covers a remote investigation of an air bag deployment crash that involved a 1998 Buick Century Custom (case vehicle, vehicle #3), a 1994 Pontiac Grand Am SE (vehicle #1), a 1988 Chevrolet K2500 pickup truck (vehicle #2), and a 1983 Buick LeSabre Limited (vehicle #4). This crash is of special interest because the case vehicle was equipped with redesigned air bags that deployed as a result of collision events. The unrestrained driver (81-year-old male) was partially ejected and sustained fatal, multiple heart lacerations. Vehicle #2 was following vehicle #1 as both were traveling west in the westbound lane of a two-lane, undivided, U.S. roadway, approaching an offset cross intersection, with vehicle #1 intending to make a left-hand, southbound turn. Vehicle #2 intended to continue its westerly travel path. The case vehicle (vehicle #3) and vehicle #4 were traveling east in the eastbound lane of the same roadway and intended to continue their eastbound travel paths. There is no investigating officer's report or pictorial evidence of the case vehicle driver attempting any avoidance maneuver. The front right of vehicle #2 impacted the back left of the stopped vehicle #1. Vehicle #2 was deflected into the eastbound lane and collided with the case vehicle in an offset, head-on impact, causing the case vehicle's driver and front right passenger air bags to deploy. Both vehicle #2 and the case vehicle rotated counterclockwise, with vehicle #2 coming to rest facing south and the case vehicle coming to rest facing northeast. Eastbound vehicle #4 was following the case vehicle and vehicle #4 struck the right front fender of vehicle #2 with its front left. The crash severity for the case vehicle was high (greater than 40 km.p.h. [25 m.p.h.]). There is no knowledge of the case vehicle driver's pre-crash posture or seat adjustments. The case vehicle's unrestrained driver sustained multiple lacerations to the heart, lacerated pericardial cavity with the heart avulsed, torn aorta, lacerated lower lobe of left lung, bilateral rib fractures, contused right lung, ruptured diaphragm, pubic symphysis separation, and other fractures and integumentary injuries.

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BACKGROUND

IN99-036

This case was brought to the NHTSA's attention by a review of the 1998 Fatality Analysis Reporting System (FARS) in February 1999. The crash involved a 1998 Buick Century Custom (case vehicle, vehicle #3), a 1994 Pontiac Grand Am SE (vehicle #1), a 1988 Chevrolet K2500 pickup truck (vehicle #2), and a 1983 Buick LeSabre Limited (vehicle #4). The crash occurred in June 1998, at 3:32 p.m., in Wisconsin, and was investigated by the applicable sheriff's department. This case is of special interest because the case vehicle (vehicle #3) was equipped with redesigned air bags that deployed as a result of collision events. The case vehicle's unrestrained driver (81-year-old male) was partially ejected and sustained fatal, multiple heart lacerations. The Police Crash Report was received in March 1999, the autopsy report in June, and on-scene photographs in June. This report is based on the Police Crash Report, the autopsy report, on-scene photographs, occupant kinematic principles, and this contractor's evaluation of the evidence.

CRASH CIRCUMSTANCES

Vehicle #1 was traveling west in the westbound lane of a two-lane, undivided, U.S. roadway, approaching an offset cross intersection and intending to make a left-hand, southbound turn. Vehicle #2 was also traveling west in the westbound lane of the same roadway and intended to continue its westbound travel path. The case vehicle (vehicle #3) and vehicle #4 were traveling east in the eastbound lane of the same roadway and intended to continue their eastbound travel paths (**Figure 1**). An extra eastbound lane existed across the intersecting south leg's mouth: on the west side of the mouth the extra lane functioned as a right-hand turn lane and on the east side of the mouth the extra lane functioned as an acceleration lane. It was daylight and overcast, with moderate-to-heavy rain. The roadway was bituminous, wet, straight, and level, with no roadway defects or vision obstructions noted. The posted speed limit for both directions was 80 km.p.h. (50 m.p.h.). Traffic controls consisted of a double solid yellow (no passing) centerline through the intersection, a single solid white edge line on the north pavement edge, two single solid white lines for eastbound traffic (one as a lane line and the other as an edge line), a No Passing Zone Sign (Manual on Uniform Traffic Control Devices: W14-3) for eastbound traffic east of the intersection, and Stop Signs (R1-1) on the north and south offset intersection legs The first harmful event occurred in the westbound lane, with the second and third impacts taking place in the eastbound lane.

Figure 1: Eastbound view of crash scene; Note: FARS vehicle #1 in left foreground, vehicle #2 straddling the centerline, vehicle #4 immediately to right of vehicle #2, and the case vehicle at far right (case photo #01)

The front right of vehicle #2 (**Figure 2** above)

Figure 2: Front damage to vehicle #2; Note: front right damage from impact #1, front left damage from impact #2, and right side damage from impact #3 (case photo #16)

impacted the back left of the stopped vehicle #1, causing vehicle #1 to angle towards the north roadside post-impact and come to rest facing west-southwest. This first impact caused vehicle #2 to be deflected into the eastbound lane and collide (impact #2) with the case vehicle (vehicle #3) in an offset, head-on impact, causing the case vehicle's driver and front right passenger air bags to deploy. Both vehicle #2 and the case vehicle rotated counterclockwise, with vehicle #2 coming to rest facing south and the case vehicle coming to rest facing northeast (**Figure 3** above). Eastbound vehicle #4 was following the case vehicle (vehicle #3) and, when vehicle #2 and the case vehicle came to rest blocking the eastbound travel lane, vehicle #4 struck the right front fender of vehicle #2 with its front left (impact #3). Vehicle #2 rotated counterclockwise and vehicle #4 rotated slightly counterclockwise and they came to rest side-by-side, facing east, with vehicle #2 straddling the centerline and vehicle #4 close by in the eastbound lane. The Police Crash Report indicated that the case vehicle was involved in impact #3 with vehicle #2 and vehicle #4, but it is this contractor's belief that the case vehicle's final rest position and damage pattern resulted from impact #2 and do not result from a possible involvement in that third impact. As well, the right front fender damage to vehicle #2 begins at its right front door's forward seam and extends to the front bumper, a length that would have included most of vehicle #4's front end width.

Figure 3: Front left damage to the case vehicle (case photo #04)

Case Vehicle (Vehicle #3)

The case vehicle (vehicle #3) was a front wheel drive, 1998 Buick Century Custom, six-passenger, four-door sedan (VIN: 2G4WS52M2W1------), equipped with a 3.1 liter, V-6, gasoline engine and a four-speed automatic transmission with a column-mounted shift lever. Four-wheel anti-lock brakes are standard for this vehicle. The case vehicle's wheelbase was 277 centimeters (109.0 inches). No odometer reading was reported. The case vehicle was towed from the scene due to disabling damage.

Figure 4: Left side view of case vehicle; Note: driver partially ejected (case photo #07)

The case vehicle sustained direct contact damage to the left half of the frontal plane, including the following components (**Figure 4** above): the front bumper, fascia, and splash pan displaced rearward; the grille and both headlamp assemblies shattered; the left half of the hood pushed rearward and tent-folded; the back hood edge contacted, creased, and splintered the lower portion of the windshield; the left front fender pushed back into the cowl and the lower left A-pillar; the left front tire and wheel assembly pushed rearward into the lower left A-pillar, which resulted in a vertical upper left A-pillar; and the upper left A-pillar received direct contact. The left lower and upper A-pillar damage caused the left front door to be sprung open and the unrestrained driver to be partially ejected. The left front door glazing was shattered

(kernelized).

There was severe intrusion into the case vehicle's driver seat area (**Figure 5**). The toe pan was pushed rearward and the foot well upward. The left side of the instrument panel was shoved rearward and upward. The left lower and upper A-pillars were crushed inward and rearward. The steering column and wheel were pushed up and rearward. The left side of the front header was buckled down and the windshield glazing sagged inward. The left side rail buckled downward. An estimated CDC for the case vehicle from acquired commercial photographs is **12-FYAW-6**, principal direction of force 0 degrees. The WinSMASH reconstruction program, with CDC-only estimated crush profile, was used on the case vehicle's single impact (impact number two of the three in the crash sequence). These CDC-only calculations provide a borderline reconstruction, but the results appear reasonable. The Total, Longitudinal, and Lateral Delta Vs are, respectively: 67 km.p.h. (42 m.p.h.), -67 km.p.h. (-42 m.p.h.), and 0.0 km.p.h. (0.0 m.p.h.). The crash severity for the case vehicle was high [greater than 40 km.p.h. (25 m.p.h.)].

Figure 5: Case vehicle's driver seat area; Note: intruding components caused reduction of occupant space (case photo #12)

CASE VEHICLE DRIVER

The case vehicle's driver [81-year-old male; White, unknown if Hispanic; 175 centimeters and 72 kilograms (69 inches, 158 pounds)] was not restrained by the available, manual, three-point, lap and shoulder safety belt system. There was no other occupant in the case vehicle (vehicle #3). His pre-crash seat adjustments, steering wheel position, and posture are not known. He was declared dead at the scene of the crash and was transported by ambulance to an undisclosed location. The following discussion of the case vehicle driver's injuries is based on a complete autopsy report, on-scene photographs, and occupant kinematic principles.

The case vehicle's driver was probably seated in a normal driving posture, with his back against the seat back, at least one hand on the steering wheel rim, a foot in the foot well and one on a control pedal (accelerator or brake pedal). There is no investigating officer's report or pictorial evidence of the case vehicle driver attempting any avoidance maneuver. Impact #2 of the crash sequence caused the case vehicle's driver and front right passenger air bags to deploy and caused the driver to move forward and upward. He encountered the deploying driver's air bag with his face and sustained contusions to the left eyelid, right orbital rim, and right cheek, with an abrasion to the right cheek, as well. He continued forward into the deflating air bag and onto the steering wheel, rim, hub, and/or spokes and received the following injuries: multiple lacerations to the heart, lacerated pericardial cavity with the heart avulsed, torn aorta, lacerated lower lobe of left lung, bilateral rib fractures (2-8 right and 1-8 left), contused right lung, ruptured diaphragm, palpable gap of pubic symphysis, extensive lacerations to left pleura, lacerated spleen, multiple

liver lacerations, and several fractures of the pelvis with extensive hemorrhage. Contact with the front roof header caused an abrasion from the left eyebrow over the top of the head. As the case vehicle began to rotate counterclockwise, the unrestrained driver's upper torso began to shift leftward. His lower torso movement was restricted by his ankles (both fractured) and lower extremities (a multiplicity of integumentary injuries: contusions and abrasions) being pinned by the toe pan and left lower instrument panel. His upper torso slid out of the space available from a partially opened left front door and sustained an abraded left costal margin. At final rest, the case vehicle's driver was partially ejected, with his head, shoulders, and arms in contact with the pavement, sustaining ecchymoses to the right lateral scalp and the anterior frontoparietal scalp.

CASE VEHICLE DRIVER INJURIES

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1.	Multiple lacerations of the heart, at posterior apex, right atrium, interatrial septum and mitral valve ring	441016.6 untreatable	Steering wheel rim, hub and/or spokes	Probable	Autopsy
2.	Lacerated aorta, hemorrhage not confined to mediastinum (400 ml left and 50 ml right hemothorax)	420218.6 untreatable	Steering wheel rim, hub and/or spokes	Probable	Autopsy
3.	Pericardial cavity lacerated and heart avulsed	441606.5 critical	Steering wheel rim, hub and/or spokes	Probable	Autopsy
4.	Laceration, left lung, lower lobe	441418.4 severe	Steering wheel rim, hub and/or spokes	Probable	Autopsy
5.	Multiple rib fractures, right 2-8 and left 1-8, many with several fractures	450240.4 severe	Steering wheel rim, hub and/or spokes	Probable	Autopsy
6.	Multiple fractures of the pelvis with abundant soft tissue hemorrhage	852606.4 severe	Steering wheel rim	Probable	Autopsy
7.	Contusions, right lung	441402.3 serious	Steering wheel rim, hub and/or spokes	Probable	Autopsy
8.	Rupture of diaphragm (stomach in left pleural cavity)	440604.3 serious	Steering wheel rim, hub and/or spokes	Probable	Autopsy
9.	Separation of pubic symphysis (palpable gap)	853000.3 serious	Steering wheel rim	Probable	Autopsy
10.	Extensive lacerations, left pleura	441800.2 moderate	Steering wheel rim, hub and/or spokes	Probable	Autopsy
11.	Lacerations, spleen	544220.2 moderate	Steering wheel rim	Probable	Autopsy

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
12.	Lacerations, liver	541820.2 moderate	Steering wheel rim	Probable	Autopsy
13.	Fractures, left ankle	852000.2 moderate	Floor/toe pan	Probable	Autopsy
14.	Fractures, right ankle	852000.2 moderate	Floor/toe pan	Probable	Autopsy
15.	Contusions, left eye lid and orbit	297402.1 minor	Driver's air bag	Probable	Autopsy
16.	Contusion, right orbital rim	297402.1 minor	Driver's air bag	Probable	Autopsy
17.	Abrasion, from left eyebrow over top of head	290202.1 minor	Windshield header/roof	Probable	Autopsy
18.	Abrasions, nose	290202.1 minor	Driver's air bag	Probable	Autopsy
19.	Abrasion, right cheek	290202.1 minor	Driver's air bag	Probable	Autopsy
20.	Contusion, right cheek	290402.1 minor	Steering wheel rim	Possible	Autopsy
21.	Laceration, above left elbow	790602.1 minor	Left front door window glazing	Possible	Autopsy
22.	Abrasion, dorsum of left palm	790202.1 minor	Steering wheel rim	Possible	Autopsy
23.	Avulsion, left small finger, finger print area	790802.1 minor	Windshield glazing	Possible	Autopsy
24.	Abrasions, chest (left costal margin)	490202.1 minor	Left front door	Possible	Autopsy
25.	Contusion, distal penis	543010.1 minor	Steering wheel rim	Probable	Autopsy
26.	Avulsion, left lateral thigh, distal	890802.1 minor	Left instrument panel	Possible	Autopsy
27.	Abrasions, left lateral thigh	890202.1 minor	Left instrument panel	Possible	Autopsy
28.	Contusion, left lower leg, proximal	890402.1 minor	Left instrument panel	Possible	Autopsy
29.	Contusion, right knee and distal thigh	890402.1 minor	Left instrument panel	Possible	Autopsy
30.	Abrasions, right knee and ankle	890202.1 minor	Left instrument panel	Possible	Autopsy

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
31.	Contusion, left foot	890402.1 minor	Floor/toe pan	Possible	Autopsy
32.	Contusion, right foot	890402.1 minor	Floor/toe pan	Possible	Autopsy
33.	Contusion, right frontoparietal scalp	190402.1 minor	Ground (pavement)	Possible	Autopsy

VEHICLE NUMBER 2

Vehicle #2 was a rear wheel drive, 1988 Chevrolet K2500, 3/4-ton, 4x4 pickup truck (VIN: 1GCFK24K7JZ------). Vehicle #2 was towed from the scene due to disabling damage (**Figure 6**). The driver [18-year-old male; race, ethnicity, height, and weight unknown] sustained police-reported "A" (incapacitating) injuries and was transported by ambulance to a medical facility. He was alone in vehicle #2.

Figure 6: Left side view of vehicle #2's front damage; Note: LF door in front of vehicle and location of LF wheel assembly (case photo #18)

Damage to vehicle #2 resulting from the vehicle-to-vehicle impact with the case vehicle consisted of: left half of the front bumper, grille, left headlamp assembly, front engine compartment brackets on left side, left side of radiator, left side of hood with a center contact divot from case vehicle's A-pillar, left front fender, and the left front tire and wheel assembly. For impact #2, an estimated CDC for vehicle #2 from on-scene photographs is: **12-FYEW-4**, with principal direction of force 0 degrees. The WinSMASH reconstruction program, with CDC-only estimated crush profile, was used on vehicle #2's impact with the case vehicle (impact #2 of the three in the crash sequence). The Total, Longitudinal, and Lateral Delta Vs are, respectively: 52 km.p.h. (32 m.p.h.), -52 km.p.h. (-32 m.p.h.), and 0.0 km.p.h. (0.0 m.p.h.).

VEHICLE NUMBER 1

Vehicle #1 was a front wheel drive, 1994 Pontiac Grand Am SE, five-passenger, four-door sedan (VIN: 1G2NE5535RC------). Vehicle #1 was not involved in any contact with the case vehicle and was towed from the scene due to disabling damage. The driver [62-year-old female; race, ethnicity, height, and weight unknown] sustained police-reported "C" (possible) injuries and was transported by ambulance to a medical facility. She was alone in vehicle #1.

Vehicle #4 was a rear wheel drive, 1983 Buick LeSabre Limited, four-door sedan (VIN: 1G4AP69Y8DH------). Vehicle #4 was not involved in any contact with the case vehicle and was towed from the scene due to disabling damage (**Figure 7**). The driver [18-year-old male; race, ethnicity, height and weight unknown] sustained police-reported "C" (possible) injuries and was transported by ambulance to a medical facility. He was alone in vehicle #4.

Figure 7: View of final rest positions for vehicles #2 (pickup truck) and #4 (car) (case photo #20)